CHAPTER 4

POWER PLANT (AC): DISTRIBUTION SYSTEM

The AC generator switchboard controls and monitors the output of the two AC generators and supplies AC power to the power distribution panels. These panels receive power through main circuit breakers and distribute this power to all AC-operated equipment located on the barge.

GENERATOR SWITCHBOARD SPECIFICATIONS

This section describes the AC generator switchboard, hereafter referred to as the AC switchboard. The following table and illustration present data on the switchboard front panel and its components.

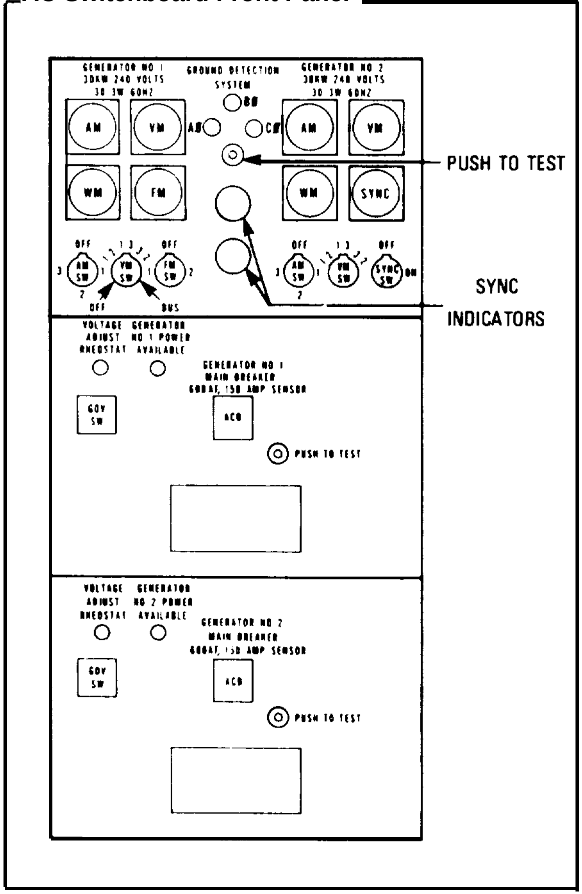
AC Switchboard Data

CONTROL METER, OR INDICATOR	FUNCTION
Air circuit breaker, Type TJ53601, 600-amp frame breaker (one for each generator), has 100-amp long-time delay, 800-amp short-time delay, and 1,200-amp instantaneous tripping, with 120-VAC undervoltage release, SPOT auxiliary switch, and manually operated breaker drawout.	Makes 240-VAC, 3-phase, 60-Hz power from AC generator available to engine room, 240-VAC-load center panel.
PUSH-TO-TEST push button.	Permits mechanical simulation of overcurrent tripping for test purposes and acts as a means of tripping the breaker m an emergency situation.
Reverse power relay.	Automatically shuts off 240-VAC power to the engine room, 240-VAC-load center panel {by opening main circuit breaker) when the relay senses load-current reversal.
VOLTAGE ADJUST rheostat (one for each generator).	Varies the AC generator output voltage (by varying sensing voltage circuit at voltage regulator unit).
GOVERNOR switch (one for each engine).	Drives the governor motor to increase or decrease the speed of the diesel engine. This increases or decreases the speed of the AC generator, consequently increasing or decreasing the output frequency.
Voltmeter, 0- to 300-V scale (one for each generator).	Indicates AC generator output voltage.
Voltmeter swttch (one for each voltmeter).	Connects voltmeter to associated AC generator output circuit. Switch has five positions OFF, "1-2," "2-3," "3-1" (corresponding to A phase, B phase, and C phase respectively), and "BUS."

AC Switchboard Data (Continued)

CONTROL, METER, OR INDICATOR	FUNCTION
Ammeter, 0- to 200-amp scale (one for each generator.)	Indicates AC generator output current.
Ammeter switch (one for each ammeter).	Connects ammeter to associated AC generator output circuit. Switch has four positions "OFF," "1," "2," and "3' (corresponding to A phase, B phase, and C phase respectively)
Wattmeter, 0- to 80-kw scale (one for each generator).	Indicates load at associated AC generator output.
Frequency meter, 55- to 65-Hz scale.	Indicates frequency of selected AC generators.
Frequency meter switch.	Connects frequency meter to AC generator load circuit; selects generator 1 or 2.
Synchroscope.	Used to synchronize frequency of one AC generator with the other and to divide load between the two generators.
Synchroscope switch.	Allows selection of engine-generator set to be synchronized (should be set to synchronize oncoming generator set).
Synchroscope lights.	Work m conjuction with synchroscope when synchronizing generator loads. One light is connected to A phase of generator 1 and the other to A phase of generator 2.
GENERATOR NO 1 (or NO 2) POWER AVAIL-BLE indicator.	Lights to indicate that associated AC generator is operating and output voltage is available.
Ground fault detect lights.	When PUSH- TO-TEST is depressed, all three indicators will light. If no ground is present, all three indicators will show same brightness. If a ground is present in a particular phase, indicator for that phase will be dim, other two indicators will be bright.
PUST-TO-TEST switch.	Connects a ground fault detector circuit indicator to each phase of AC generator output.

AC Switchboard Front Panel



FUNCTIONAL DESCRIPTION

The following paragraphs describe the operation of the synchroscope, generator reverse-current relay, and air circuit breaker drawout assembly.

Synchroscope

The synchroscope is of the rotatable, polarized iron-vane type. The stator, operating in conjunction with the moving iron vane, has an independent exciting coil. The winding is connected to one phase of the incoming machine through a phase-splitting network that produces a rotating field. The exciting coil is connected to the corresponding phase of the running machine. The moving vanes are thus polarized by the resulting field. The action of these two fields is such that the vane will indicate the phase difference.

To indicate synchronism between two systems correctly, the synchroscope must be connected to corresponding phases of the two systems; for example, to phase A of both generators 1 and 2. The field coil with its impedor is connected through a potential transformer to the system or bus already energized. The polarizing coil is connected through another potential transformer to the generator which is to be synchronized with the system.

If the pointer remains in the vertical position, the two sources are in synchronism. If the needle remains in a position other than vertical, the two sources are operating at the same frequency, but with a phase angle between them proportional to the angle the pointer takes from the vertical. A rotating pointer indicates a difference in frequency between the two sources equal to the frequency of the rotation of the pointer. The markings on the synchroscope dial will indicate whether the oncoming generator is running faster or slower than the bus. The scale has a synchronism mark at "12o'clock" with a “fast” arrow pointing clockwise and a “slow” arrow pointing counterclockwise. The speed of the generator must be varied to synchronize it with the bus.

The calibration of the instrument can be checked by connecting both windings to the same source. The pointer should then indicate synchronism. If the pointer does not indicate synchronism, it should be shifted to the vertical position.

Generator reverse-current relay

When a generator is operating in parallel with another and its prime mover (diesel engine) fails, the generator will take power from the system, run as a motor, and drive the prime mover. This could damage the prime mover. To prevent this, the reverse-current relay will trip the generator circuit breaker and take the generator off the bus when the reverse power exceeds the relay setting. The setting is chosen according to the particular requirements of each generator set.

Air circuit breaker drawout assembly

The drawout mechanism is designed for heavy-duty applications. It permits rapid examination and maintenance of the circuit breaker without having to de-energize the switchboard bus structure. The drawout has four discrete positions: engaged, test, disengaged, and fully withdrawn. Mechanical interlocking is built in to prevent the movement of a closed breaker into or out of the engaged or test position.

The racking handle is an integral part of the drawout frame. All main and secondary contacts are self-aligning. The carriage can be hand-rotated 180 degrees on the rails for contact inspection or maintenance.

MAINTENANCE

Preventive maintenance

The following suggested inspection schedule is based on average operating conditions. The actual frequency should be adjusted according to operating conditions as experience dictates.

Monthly Inspection Schedule

WHAT TO INSPECT	WHAT TO INSPECT, FOR
Magnetically operated devices contractors, relays, and solenoids	- Control-circuit voltage - Collections of dirt or gum - Excessive heating of parts indicated by discoloration of metal parts, charred insulation, or odor - Freedom of moving parts (no binding or sticking) - Corrosion of metal parts - Remainng wear allowance on contacts - Loose connections - Condition of flexible shunts - Worn or broken mechanical parts - Excessive arcing in opening circuits - Excessive noise in AC magnets - Evidence of dripping liquid falling on control
Thermally operated devices	- Collections of dirt or gum - Excessive heating of parts indicated by discoloration of metal parts, charred insulation, or odor - Freedom of moving parts (no binding or sticking) - Corrosion of metal parts - Proper contact pressure - Loose connections - Condition of flexible shunts - Worn or broken mechanical parts - Excessive arcing in opening circuits - Evidence of dripping liquid falling on control - Condition of heating element - No binding of contacts when latching mechanism trips
Static accessories resisiors, rectifiers, capacitors, transformers, fuses, wrong, and bus and cable work	- Collections of dirt or gum - Excessive heating of parts indicated by discoloration of metal parts, charred insulation, or odor - Corrosion of metal parts - Loose connections

Semiannual Inspection Schedule

WHAT TO INSPECT	WHAT TO INSPECT FOR
Mechanically operated devices master witches, pushbuttons, selector switches, manual starters, and rheostats	- Collections of dirt or gum - Excessive heating of parts indicated by discoloration of metal parts, charred insulation, or odor - Freedom of moving parts (no binding or sticking) - Corrosion of metal parts - Remaining wear allowance eon contacts - Proper contact pressure - Loose connections - Condition of flexible shunts - Condition of arc chutes or barriers - Worn or broken mechanical parts - Excessive arcing reopening circuits - Condition and level of oil (if oil-immersed); presence of sludge - Condition of gaskets (for oil-immersed, dust-tight, or watertight units) - Evidence of dripping liquid falling on control - Condition of control-circuit contacts - Wear or roughness on sliding contacts - Lubrication of contacts where recommended
Arc chutes or barriers	- Corrosion if almost burned through, replace to prevent arc heat from burning out pole pieces or shorting the next phase
Flexible shunts	- Corrosion - Damage from wear - Condition flex or twist slighly to check
Interlocks	- Adjustment according to manufacturer's instruction book
Push button, overload relay, contacts, and so forth	- Freedom of function to provide protection in an emergency

Corrective maintenance

The following paragraphs describe the cleaning and care of fuse clips, ferrules, and silver contacts. Refer also to Distribution Panels in this chapter for inspecting and cleaning of electrical components.

Dry dust and dirt should be blown off with dry compressed air. This is important since dust may not only prevent the control devices from operating normally but may also contain conducting material that will ultimately form a short circuit between points of different potentials. Dust on the surfaces of interlocks may prevent a circuit from being completed, even when the contacts are in the closed position. *Grease, oil, or sticky dirt* is removed with a cleaning fluid. Do not soak the parts, particularly the coils, with the cleaner. Use just enough to loosen and wipe off the grease. For cleaning small parts, a small paintbrush dipped into the cleaning solution is good for getting into corners and crevices.

Most *fuse clips* and *fuse ferrules* are plated to resist corrosion. However, it is well to remove the fuse from the clip occasionally and polish the contact surfaces. In replacing the fuses, be sure that they fit snugly into the clips.

Contractors, up to 100-amp capacity, as well as small relays, use *silver contacts*. These oxidize more slowly than copper contacts. Any silver oxide formation on the contact is self-reducing. Therefore, it is not necessary, or recommended. to file fine silver contacts to remove the oxide. It takes very little filing to destroy the contact's usefulness completely.

If any sulphur gas is present in the atmost sphere, a sulp hide may form on the silver. If the contact pressures are light and the voltage low, this condition may prevent the flow of current when the contacts close. The sulphide, darker in color than the oxide, should be cleaned off if it causes trouble.

The following tables present trouble-shooting remedies for the electrical com- - ponents of the generator switchboard.

Troubleshooting Chart : Air Circuit Breakers

SYMPTOM	PROBABLE CAUSE	REMEDY
Premature tripping.	Setting too low for motor starting current.	Increase trip setting slightly.
	Repetitive closing or logging of motor starting currents.	Check type of load and current peaks with trip setting.
	Undervoltage device control circuit and auxiliary pilot devices affected by open circuit or loss of voltage.	Same as above.
	Incorrect trip rating.	Adjust trip rating.
Failure to latch in, open, or reset.	Incorrect adjustment of trip mechanism.	Refer to breaker instructions and adjust.
	Worn parts such as pins, links, or broken springs.	Check and adjust all operating parts and Control circuits.
	Excessive currents causing contact wear.	Check to see that current rating IS not exceeded; adjust as necessary.
	Fault in remote control circuit.	Check operation of reverse. current relay.
	Trip element or mechanism damaged due to excessive current.	Repair or replace, then check current rating and adjust if necessary.
	Excessive corrosion or accumulation of foreign material.	Check environmental conditions and clean unit.
	Arc chutes damaged due to excessive currents.	Check to see that current rating IS not exceeded.
	Binding in attachments preventing resetting of latch.	Realign and adjust attachments.
	Chipped or worn latch.	Replace latch.
	Latch out of adjustment.	Adjust latch.
	latch return spring too weak or broken.	Replace spring.
	Hardened or gummy lubricant.	Clean bearing and latch surfaces.

Troubleshooting Chart : Air Circuit Breakers (Continued)

SYMPTOM	PROBABLE CAUSE	REMEDY
False tripping.	Binds in overload device.	Replace overload device.
Failure to trip.	Travel of tripping device does not permit positive release of tripping latch.	Readjust or replace device.
	Worn or damaged trip unit parts.	Replace trip unit.
Short contact life.	Corrosion on contacts.	Check motor starting current.
	Excessive currents and frequent closing and opening of circuit.	Check motor starting current; reduce duty cycle.
	Short circuits, loose connections.	Check circuit operation; tighten connections.
	Misapplication.	Check current rating.
	Excessive filing or dressing.	Replace contacts.

Troubleshooting Chart :Contacts

SYMPTOM	PROBABLE CAUSE	REMEDY
Welding of contacts.	Abnormal inrush motor starting currents.	Reduce currents.
	Rapid jogging.	Use suitable contactor to switch circuit to normal duty.
	Incomplete manual closure.	Frequent inspection of contacts.
	Inadequate maintenance for renewal of contacts.	Renew contacts.
Contact chatter.	Poor contact in control pickup circuit.	Improve the contact or use holding interlock.
	Excessive jogging.	Find out whether device IS recommended for jogging service. If it is not, caution operator.
	Broken pole shade.	Replace, or order new magnet assembly.
	Contactor slams, thus opeing interlock in coil circuit.	Increase wipe and pressure on interlock.
Overheating of contacts.	Copper oxide on contacts.	Install silver-faced contacts.
		If copper contacts, file with fine file. (CAUTION excess filing wears out the contacts Never file silver. faced contacts.)
	Carrying load continuously for a long time.	Install silver-faced contacts.
	High reductive loads such as DC fields.	Install silver-faced contacts.
	Sustained overload.	Reduce current or install a larger device.
	Insufficient contact pressure.	Clean, adjust.

Troubleshooting Chart : Contacts (Continued)

SYMPTOM	PROBABLE CAUSE	REMEDY
Overheating of contacts (Continued).	Loose connection.	Clean and tighten. (Measurement of the milivolt drop across the current-carrying connections will indicate where excessive heating originated.)
	Contacts not aligned.	Adjust contacts.
	Contacts dirty, greasy, or coated with dark film.	Clean contacts.
	Contacts badly burned or pitted.	Replace contacts.
	Current-carrying surfaces dirty.	Clean surfaces of current-carrying parts.
	Bolts and nuts of points at terminals.	Tighten, but do not exceed limits of bolts or fittings.
	Current in excess of breaker rating.	Decrease load, rearrange circuit, or Install larger breaker.
	Excessive ambient temperature.	Provide adequate ventilation.
Wear contact pressure.	Wear allowance gone.	Replace and adjust.
	Poor contact adjustment.	Adjust gap and "wipe."
	Low voltage preventing magnet seal.	Correct voltage condition (possible line regulation).
Welding or freezing of contacts.	Abnormal inrush of currents of more or less than 10 times continuous rating. (this will vary depending on the type of device.)	Reduce currents.
		Substitute special nonweld contacts.
		Install larger deivce.
		Install copper contacts (CAUTION Check for overheating of copper contacts).
	Rapid jogging.	Install copper contacts if otherwise suitable.
Overheating of sliding contacts.	Overcurrent; weak contact pressure; oxidation; high ambient; rough contacts.	For very heavy service, use special alloy contacts lubricate periodically as manufacturer recommends.
Abrasion and roughening of sliding contacts.	lack of maintenance and lubrication, very heavy service, arcing; oxidation; abrasive dirt.	Sliding contacts usually require lubrication. (Use lubricant recommended by manufacturer) Special alloy contacts should be specified for extra heavy service.
Arc chutes pitted, worn, or broken.	Abnormal interrupting duty (inductive loads); excess vibration or shock.	Check application.
	Moisture.	Eliminate moisture. or keep several chutes on hand for replacement.
	Improper assembly.	Replace with correct assembly.
	Rough handling.	Handle more carefully.

Troubleshooting Chart : Contacts (Continued)

SYMPTOM	PROBABLE CAUSE	REMEDY
Insulation failure.	Overvoltage, voltage transients, high Induced voltages.	Correct system voltage.
	Mechanical damage.	Replace damaged parts.
	Moisture, dirt, and fumes, overheating (carbonizing).	Keep controls clean and dry. Get special coil for application.

Troubleshooting Chart : Coils
(Includes series and blowout coils)

SYMPTOM	PROBABLE CAUSE	REMEDY
Coil failure.	Moisture, corrosive atmosphere.	Relocate coils or use special resistant coils.
Open circuit, not "roasted."	Mechanical damage.	Do not handle coils by the leads.
	Excess vibration or shock; coil movement causing insulation failure or broken wire.	Relocate and provide a special mounting. Coils should be held firmly in place.
Overheated, "roasted."	Overvoltage or high ambient.	Check application and circuit.
	Wrong cod, short.time-rated cod energized too long.	Check manufacturer's instructions.
	Shorted turns caused by mechanical damage, corrosion, or conducting of dust.	Replace coil and correct conditions if practical to practical to do so.
	Too frequent operation (very rapid jogging of AC Coils)	Check application.
	Undervoltage, failure of magnet to seal in.	Check circuit Interlock.
Series or blowout coils overheated.	Excessive current rating used.	Install larger coil, or reduce current.
	High ambient temperature.	Relocate or regulate temperature.
	loose connection, corrosion, or oxidation on connection surfaces.	If connection is hot, clean before tightening.

Troubleshooting Chart : Shunts, Magnets, and Other Mechanical Parts

SYMPTOM	PROBABLE CAUSE	REMEDY
Flexible shunt failure.	Improper installation.	See manufacturer's instructions.
	Large number of operations; worn out mechanically.	Replace shunt.
	Corrosive atmosphere or moisture.	Incorrect application.
	Burned by arcing, oxidized connection.	Check application and system voltage.
Worn or broken pans.	Heavy slamming caused by overvoltage, underload, or wrong coil. Chattering caused by broken pole shader or poor contact in control circuit. heavy duty cycle, too much jogging.	Replace part, and correct cause of damage.
	Abrasive dust, mechanical abuse.	Clean; use correctly.
Noisy magnet.	Broken pole shader, magnet faces not true as result of wear or mounting strains.	Replace.
	Dirt or rust on magnet faces.	Clean.
	Low voltage.	Check system voltage.
	Improper adjustment, magnet overloaded.	Check manufacturer's instruction sheet.
Broken pole shade.	Heavy slamming caused by overvoltage, magnet underloaded, weak tip pressure, or wrong coil.	Replace and correct the cause.
Failure to pick up.	Low voltage on coil.	Check system voltage.
	Coil open, wiring of coil, or shorted turns.	Replace.
	Wrong coil.	Replace with correct type.
	Excessive magnet gap; magnet overloaded.	Check instruction sheet.
Failure to drop out.	Mechanical binding.	Check instruction sheet and adjust.
	Gummy substance on magnet faces.	Clean.
	Worn bearings.	Replace the part.
	Nonmagnetic gap m magnet circuit destroyed.	Replace magnet.
	Voltage not removed.	Check coil voltage.
	Not enough mechanical load on magnet, Improper adjustment.	Check instruction sheet and adjust.

Troubleshooting Chart : Capacitors, Resistors, Transformers, and Fuses

SYMPTOM	PROBABLE CAUSE	REMEDY
Breakdown or failure of dielectric in capacitor.	Overvoltage.	Check system voltage.
	Voltage surges caused by switching or lightening.	Install protective equipment.
	Some types not usable with AC.	Check application.
	Moisture, corrosion, or high temperature.	Correct condition, or install special unit.
	Continuous voltage on intermittent-rated unit.	Install proper unit.
	Mechanical damage.	Replace capacitor.
Insulation failure of resistor, overheating.	Rating too low.	Install larger resistor.
	Running on starting resistor.	Check the timer to make sure it operates.
	Restricted ventilation.	Relocate.
Insulation failure of resistor, open circuit.	Burned out from overheating.	Replace resistor and see above.
	Corrosion, moisture, or acid fumes.	Relocate or correct atmospheric conditions.
	Mechanical damage.	Replace worn or broken parts.
Overheating of transformer.	Overcurrent or overvoltage.	Check load on transformer and system voltage.
	Intermittent-rated unit left on continuously.	Check circuit operation and correct accordingly.
	High ambient temperature.	Relocate transformer or reduce load.
	Shorted turns.	Replace coil.
Premature blowing of fuse.	Wrong fuse for application.	Replace fuse with correct rating.
	Heating at ferrule contacts; corrosion or oxidation of ferrules and clips.	Keep ferrutes and clips clean.
		Use plated clips and ferrules, replace annealed clips.
	Weak contact pressure.	Provide adequate pressure.
Delayed blowing of fuse.	Wrong fuse for application.	Replace fuse with correct rating.

DISTRIBUTION PANELS

FUNCTIONAL DESCRIPTION

The power distribution panels receive AC generator power from the AC switchboard through main circuit breakers. They distribute this power to all AC-operated equipment on the barge. Shore power can be selected at the engine room 240-VAC-load center panel in place of the AC generators. These circuit breakers for shore power are mechanically interlocked so only one source of power can be selected at a time.

The following power distribution panels are covered in this section and each is described in the order listed:

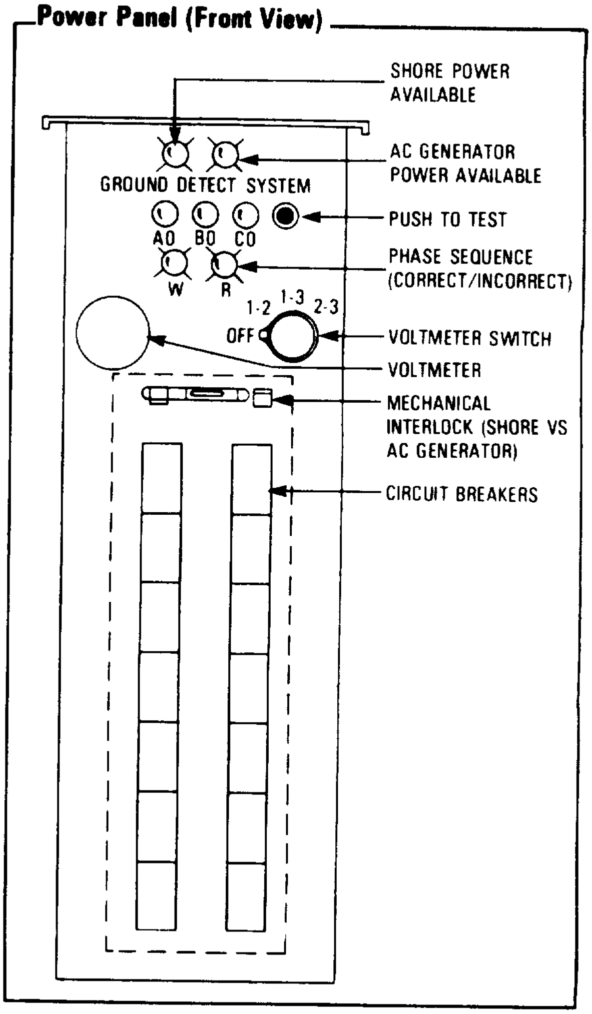
- Engine room, 240-VAC-load center power panel (P-0203)
- Engine room, 120-VAC-load center panel (P-01 10)
- (Galley, 240-VAC power panel (P-205)
- CHT room, 240-VAC power panel (P-207)
- Crane machinery house, 240-VAC power panel (P-209)
- Crane machinery house, 120-VAC power panel (P- 109A)
- Galley and quarters, 120-VAC power panel (P-104)
- Engine room, 120-VAC power panel (P-101)
- Galley and quarters, 120-VAC lighting distribution box (P-105)
- Engine room, 120-VAC strip heater distribution box (P-103)
- Engine room, 120-VAC light distribution box (P-102)
- Operator's cab, 120-VAC light distribution box (P-0109F)

Engine room, 240-VAC-load center power panel (P-0203)

This power panel (see following illustration and table) receives 240-VAC, 3-phase power from the AC switchboard or shore power. It distributes power throughout the barge for all AC-operated equipment. The P-0203 power panel performs the following functions in addition to power distribution:

- Selects a source of power, either the AC generators through the AC switchboard or shore power through the shore power connection box. A mechanical interlock prevents simultaneous connection to the AC generators and to shore power.
- Detects ground fault on all 3-phase lines by using a PUSH-TO-TEST push button and a set of indicators, one indicator for each phase.
- Phase monitors shore power, using a set of panel lights working in conjunction with equipment installed aboard.

Engine Room, 240-VAC-Load Center Power Panel (Front View)



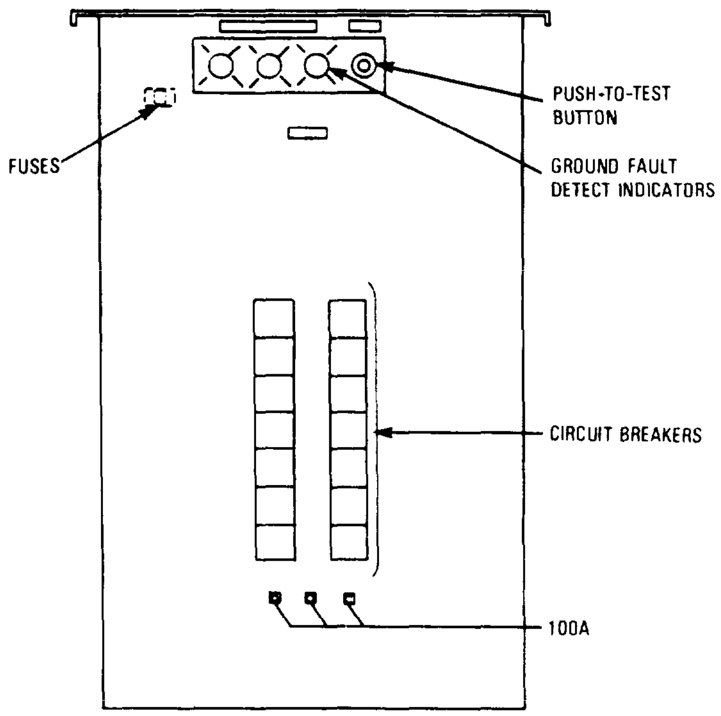
Engine Room, 240-VAC-Load Canter Power Panel Data

GENERATOR NO 1 (or NO 2) POWER AVAILABLE indicator.	Indicates AC generator(s) is (are) available to supply power, indicates AC switchboard bus is energized by one or both AC indicator. generators and this power is available for use at AC switchboard.
Voltmeter.	Monitors voltage input on shore power.
Voltmeter switch.	Connects voltmeter to shore power Switch has four positions “OFF,” “1 ,“ “2,” and “3,” corresponding to A phase, B phase, and C phase respectively.
Mechanical interlock.	Interlock function prevents AC generator power to be connected in parallel with shore power.
Phase sequence correct switch.	lights to indicate that shore power phase sequence is correct with equipment installed aboard, so that motors will run with correct rotation.
Phase sequence incorrect switch.	Lights to indicate that shore power phase sequence is not correct with equip ment installed aboard.
Ground detect system indicators (one for each phase).	When PUSH-TO-TEST push button is depressed, all three indicators will light brightly if no ground is present on any one of the three phases. If ground is present on any one phase, the light for that phase will be only dimly lit.
Circuit breaker, 15 amp.	Supplies 240-VAC, 3-phase power to the portable bilge and ballast pump motor through a motor controller (Refer to section on motor controllers in this chapter)
Circuit breaker, 30-amp.	Supplies 240-VAC, 3-phase power to the air compressor motor through a motor controller, which is interlocked with the fire pump.
Circuit breaker, 50-amp.	Supplies 240-VAC, 3-phase power to the fire pump motor through a motor controller, which is interlocked with the air compressor to prevent the air compressor from running when the fire pump is in use.
Circuit breaker, 30-amp.	Supplies 240-VAC, 3-phase power to raw-water pump number 2 through low voltage release (LVR) motor controller.
Circuit breaker, 40-amp.	Supplies 240-VAC, 3-phase power to the galley power panel (P-205).
Circuit breaker, 15-amp.	Supplies 240-VAC, 3-phase power to the supply fan in engine room through a motor controller.
Circuit breaker, 30-amp.	Supplies 240-VAC, 3-phase power to the CHT room power panel (P-207).
Circuit breaker, 15-amp.	Supplies 240-VAC, 3-phase power to raw-water pump number 1 through LVR motor controller.
Circuit breaker, 40-amp.	Supplies 240-VAC, 3-phase power to the crane machinery house 240-VAC power panel (P-209) through rotary collector rings.
Circuit breaker, 90-amp.	Supplies 240-VAC, 3-phase power to the engine room 120-VAC, 3-phase, load center panel (P-0110) through a step-down 240/1 20-VAC transformer.
Circuit breaker, 15-amp.	Supplies 240-VAC, 3-phase power to the oil-water separator pump through its own control panel.
Two circuit breakers, 15-amp.	Spares.

Engine room, 120- VAC-load center panel (P-0110)

This power panel (see following illustration and table) receives 120-VAC, 3-phase power from the 240-VAC-load center panel through 240/ 120-VAC transformers and distributes 120-VAC, l-phase power through circuit breakers to the equipment as listed. This panel is equipped with a 3-phase ground-fault detection circuit.

Engine Room, 120-VAC-Load Center Front Panel



Engine Room, 120-VAC Load Center Front Panel Data

Circuit breaker. 50-amp.	Supplies 120-VAC power to the engine room, 120-VAC power panel (P-101)
Circuit breaker. 30-amp.	Supplies 120-VAC power to the engine room, 120-VAC lighting distribution box (existing).
Circuit breaker, 30-amp.	Supplies 120-VAC power to the engine room, 120-VAC strip- heater distribution box (existing).
Circurit breaker, 50-amp.	Supplies 120-VAC power to the galley and quarters 120-VAC power panel.
Circuit breaker, 30-amp.	Supplies the galley and quarters 12 D-VAC lighting distribution box.
Circuit breaker, 15-amp.	Supplies the engine alarm panel for the DC-system diesel engines.
Two circuit breakers, 15-amp and 30-amp.	Spares.

Galley, 240-VAC power panel (P-205)

This power panel receives 240-VAC, 3-phase power through a 40-amp circuit breaker at the 240-VAC-load center panel. It distributes this power through circuit breakers to operate the equipment as listed in the following table.

Galley, 240-VAC Power Panel Data

Circuit breaker, 15-amp.	Energizes the galley and CHT room supply fan motor through low voltage protection (LVP) motor controller.
Circuit breaker, 30-amp.	Provides 240-VAC, 3-phase power to the galley range.
Two circuit breakers, 15-amp.	Spares.

CHT room, 240-VAC power panel (P-207)

This power panel receives 240-VAC, 3-phase power through a 30-amp circuit breaker at the engine room, 240-VAC-load center panel (P-0203). It distributes this power through circuit breakers to operate the equipment as listed in the following table.

CHT Room, 240-VAC Power Panal Data

Circuit breaker, 15-amp.	Energizes the transfer pump through LVP motor controller.
Circuit breaker, 15-amp.	Energizes the flushing pump through IVR motor controller.
Circuit breaker, 15-amp.	Energizes the aeration blower through LVP motor controller.
Circuit breaker, 15-amp.	Energizes the shore discharge pump through LVP motor controller.
Two circuit breakers, 15-amp.	Spares.

Crane machinery house, 240-VAC power panel (P-209)

This power panel receives 240-VAC, 3-phase power from the 240-VAC-load center panel through rotary collector rings. It distributes this power through circuit breakers to the equipment as listed in the following table.

Crane Machinery House, 240-VAC Power Panel Data

Circuit breaker, 25-amp.	Supplies 240-VAC to the crane machinery house, 120-VAC power panel (P-109A) through a 240/120-VAC, step-down transformer.
Circuit breaker, 15-amp.	Supplies 240-VAC to the air-conditioning unit in the operator's cab.
Circuit breaker, 15-amp.	Energizes the blower motor for the Dravo heater through LVR motor controller.
Circuit breaker, 25-amp.	Provides 120-VAC to the existing operator's cab, lighting-distribution panel through a 240/ 120-VAC, step-down transformer.
Two circuit breakers, 15-amp.	Spares

Crane machinery house, 120-VAC power panel (P-109A)

This power panel receives 120-VAC, 1-phase power from the crane machinery house, 240-VAC power panel (P-209) through a 240/120-VAC step-down transformer. It distributes 120-VAC, l-phase power through circuit breakers to equipment as listed in the following table. This panel is equipped with a ground-fault detection circuit.

Crane Machinery House, 120-VAC Power Panel Data

Circuit breaker, 15-amp.	Supplies 120-VAC to the machinery house and operator's cab receptacles isolated through a 2-kva (kilovolt-ampere) isolation transformer, which is used for shock protection (lamps, radios, razors) of personnel.
Circuit breaker, 15-amp.	Supplies 120-VAC to the AN/ URC-80 radio set.
Circuit breaker, 15-amp.	Supplies 120-VAC to a terminal box, which in turn supplies power to the fuel pump motor for the Dravo heater unit (existing).
Circuit breaker, 15-amp.	Supplies 120-VAC to hydraulic brake-svstem bleeder-valve solenoid.
Two circuit breakers, 15-amp.	Spares.

Galley and quarters, 120-VAC power panel (P-104)

This power panel receives 120-VAC, 3-phase power from the engine room, 120-VAC-load center panel (P-0110). It distributes 120-VAC, 1-phase power through circuit breakers to the equipment as listed in the following table. This panel is equipped with a 3-phase ground-fault detection circuit.

Galley and Quarters, 120-VAC Power Panel Data

Circuit breaker, 15-amp.	Supplies the range hood exhaust fan.
Circuit breaker, 15-amp.	Supplies the refrigerator.
Circuit breaker, 30-amp.	Supplies a 2-circuit breaker box in the galley and crew's quarters through an isolation transformer for shock protection (lamps, radios, razors) of personnel.
Circuit breaker, 20-amp.	Supplies power for one air-conditioning unit in the crew's quarters.
Circuit breaker. 15-amp.	Supplies power to seawater pump m the engine room for cooling of air-conditioning compressor in the crew's quarters.
Circuit breaker, 20-amp.	Supplies power to one air-conditioning unit in the crew's quarters.
Circuit breaker, 15-amp.	Supplies power to a seawater pump for crew quarters' air-conditioning unit.
Circuit breaker, 15-amp.	Supplies power to the summary alarm panel.
Circuit breaker, 15-amp.	Supplies power to freshwater pump (potable water).
Circuit breaker, 15-amp.	Supplies power to water cooler.
Two circuit breakers, 15-amp.	Spares

Engine room, 120-VAC power panel (P-101)

This power panel receives 120-VAC, 3-phase power from the engine room, 120-VAC-load center panel (P-0110). It distributes 120-VAC, l-phase power through circuit breakers to the equipment as listed in the following table. This panel is equipped with a 3-phase ground-f ault detection circuit.

Engine Room, 120-VAC Power Panel Data

Circuit breaker, 50-amp.	Supplies 120-VAC to the engine room, 120-VAC power panel.
Circuit breaker, 30-amp	Supplies 120-VAC to the engine room, 120-VAC lighting distribution box (existing).
Circuit breaker, 30-amp.	Supplies 120-VAC to the engine room, 120-VAC strip heater distribution box (existing).
Circuit breaker, 50-amp	Supplies 120-VAC to the galley and quarters, 120-VAC power panel.
Circuit breaker, 30-amp.	Supplies the galley and quarters, 120-VAC lighting distribution box.
Circuit breaker, 15-amp.	Supplies the engine alarm panel for DC-system diesel engines.
Two circuit breakers, 15-amp and 30-amp.	Spares.

Galley and quarters, 120-VAC lighting distribution box (P-105)

This distribution box is an existing DC panel that was reconnected to the AC system (see table below). It receives 120-VAC, 1-phase power from the engine room, 120-VAC-load center panel and distributes this power to the new unit heater fans. The other switches are not covered since they supply existing circuits.

Galley and Quarters, 120-VAC Lighting Distribution Box Data

Switch, 30-amp.	Supplies 120-VAC to two unit heater fans through its associated control relay; thermostatically controlled.
Switch, 30-amp.	Supplies 120-VAC to the other two unit heater fans through its associated control relay; thermostatically controlled.
Other switches.	Existing switches.

Engine room, 120-VAC strip heater distribution box (P-103)

This distribution box is an existing DC panel that was reconnected to the AC system. It receives 120-VAC, 1-phase power from the engine room, 120-VAC-load center panel and distributes this power to the DC and AC generators strip heaters through associated switches.

Engine room, 120-VAC light distribution box (P-102)

This distribution box is identical to that described above except that it distributes 120-VAC power to the engine room lighting circuit and to isolated receptacles used by the crew. These receptacles are connected to the distribution box through isolation transformers to provide the crew with shock protection.

Operator's cab, 120-VAC light distribution box (P-0109F)

This distribution box is an existing DC panel that was reconnected to the AC system. It receives 120-VAC, 1-phase power from the crane machinery house, 240-VAC power panel through a 5-kva, 240/120-volt, 1-phase transformer. It distributes this power to (existing lighting circuits for the crane machinery house, operator's cab, rotating platform, and boom.

MOTOR CONTROLLERS

AC power is applied to motors through controllers that provide LVP, LVR, and overload (OL) features. A table listing motors and associated motor controllers is given on page 4-20. The operation of Class 2510, 8536, and 8606 motor controllers is discussed as follows.

Class 2510

The Class 2510 motor controller acts as a manual starter, providing both OL and LVP features. The LVP is provided by a continuous-duty solenoid that is energized when line voltage is present. The starter contacts can be closed (by positioning the ON-OFF switch to ON) only when the solenoid is energized. If a loss of power occurs while the motor is operating, the solenoid will de-energize, opening the starter contacts and allowing the spring pressure to return the handle to a "center off' position (between ON and OFF). The motor is kept disconnected from the power lines after voltage is returned to operating level until the operator positions the ON-OFF switch back to ON.

An OL relay in each main power line provides OL protection for this motor controller. The OL relay consists of a heater winding through which the load current flows, a solder pot, and a ratchet wheel. A current OL condition will melt the alloy in its solder pot, allowing the ratchet wheel to rotate. This activates a trip mechanism which opens the starter contacts, allowing the handle to go to the "center off' position. After the solder has cooled, the mechanism can be reset by pushing the handle to its extreme OFF position. The motor can then be started by moving the switch to the ON position.

Class 8536

The Class 8536 motor controller acts as a magnetic starter and has LVP or LVR and OL features. The motor is started by either depressing the START push button or through a sustained-contact switch (such as a pressure switch) located in the circuit. This switch allows power to be applied to the motor when closed. The magnetic starter is used when full-starting torque and the resulting current inrush are not objectionable. When the START button is depressed or the associated sustained-contact switch is closed, the magnetic starter coil is energized. This closes a contact in each main line and connects the 3-phase power to the motor.

LVP is obtained by a normally open, momentary-contact START push button in parallel with a normally open interlock on the magnetic starter. When the START push button is depressed, the main contactor coil is energized. This causes the contacts of the main contactor to close and connects the motor to the power lines. It also closes a contact in parallel with the START push button for the holding interlock. The holding interlock assures that the main coil continues to be energized after the START button is released. When a reduction or loss of line voltage occurs, the main contactor coil is de-energized. This causes the contacts of the main contactor to open (thus stopping the motor) and breaks the holding interlock. When the line voltage returns to operating level, the START push button must be depressed to start the motor.

LVR provides for disconnecting the motor from the power lines on reduction or loss of power and keeping it disconnected until power returns. Then it automatically reconnects the motor to the power lines to restart the motor. LVR is obtained by the use of a sustained-cont switch in series with the main contactor coil. When the START switch is closed, a circuit is completed through the coil of the main contactor and the main contactor closes. on reduction or loss of voltage, the coil is de-energized and the main contactor opens. On restoration of power, the coil is energized again and the motor restarts automatically.

The OL protection feature is similar to that described in the 2510 class. The exception is that the main line overload relays operate a separate set of contacts in series with the magnetic coil, rather than operating directly on the main power line contacts. When the overload relay contacts are opened, the magnetic coil is de-energized. This then allows the main contacts to open. The overload relay mechanisms can be reset after the solder cools by depressing the RESET push button on the front of the motor controller. The motor can there be started normally.

Class 8606

The Class 8606 motor controller is the autotransformer type that includes transition-start, OL protection, and LVP or LVR. The autotransformer starting function provides reduced voltage, starting at the motor terminals, through the use of a tapped, 3-phase autotransformer. On initiation, a 2-pole contactor and a 3-pole contactor close to connect the motor to the preselected autotransformer taps. A timing relay causes the transfer of the motor from the reduced-Voltage Start to full line Voltage Operation without disconnecting the motor from the power source. This is known as closed transition-starting. Autotransformers with transition-start controllers are used to provide maximum torque available with minimum line current, with taps to permit both of these factors to be varied.

Class 8606 motor controllers are used to control the operation of the fire pump and the air compressor on the 100-ton crane barge. The fire pump controller has a LOCAL-OFF-REMOTE selector switch and START-STOP push buttons. It is connected to a remote START-STOP push-button station located on the main deck. When the selector switch is on LOCAL, the fire pump can be started either locally or remotely, but it can be stopped at the local station only. When the selector switch is on REMOTE, the fire pump can be started either locally or remotely, but can be stopped at the remote station only.

The air compressor motor controller has a HAND-OFF-AUTO selector switch and START-STOP push buttons. It is connected to a pressure switch in the air compressor discharge line. When the selector switch is on HAND, the air compressor can be controlled manually using the START-STOP push buttons. When the selector switch is on AUTO, the air compressor operation is controlled automatically by the pressure switch.

The LVP or LVR and OL features for the Class 8606 motor controllers are as described for the 8536 class. The fire pump controller provides LVP. The air compressor controller provides LVP when the selector switch is on HAND, and LVR when the switch is on AUTO.

Motor Controller/Motor Data

MOTOR	MOTOR CONTROLLER TYPE/CHARACTERISTICS
Hot water boiler circulation pump motor.	Square D, Type MCA-21, Class 2510; has ON-OFF manual starter with 120-VAC, 60-Hz LVP coil with one thermal overload relay.
Potable water pump motor.	Same as above
Fuel oil transfer pump motors (2).	Same as above.
Seawater (AC cooling) motors (2).	Same as above.
Aeration blower motor.	Square D, Type MBA-22, Class 2510; has ON-OFF switch manual starter with 240-VAC, 60-Hz LVP coil with three thermal overload relays.
Sewage transfer pump motor.	Square D, Type SBA-2, Class 8536; has START push-button magnetic starter with 240-VAC, 60-Hz LVP coil with three thermal overload ralays.
Raw-water pump motors (2).	Square D, Type SBA- 2, Class 8536; has magnetic starter with a 240/120-VAC, step-down transformer for internal control with a 120-VAC, 60-Hz LVR coil with three thermal overload relays; has no START-STOP push buttons. The start-stop motor operation is through a pressure switch in DC generator lube oil line.
Portable bilge and ballast pump moto.r	Same as raw-water pump motors except start-stop operation is from START-STOP push buttons located on the starboard side of the fixed base of the crane; it is LVP.
Sewage flushing pump motor.	Same as raw-water pump motors but has no START-STOP push buttons. Motor operation IS controlled by a pressure switch in the flushing fluid line; it is LVR.
Shore-discharge pump motor.	Same as raw-water pump motors except start-stop operation is from START-STOP push buttons on main deck; it is LVP.
Galley and CHT room supply fan motor.	Same as raw-water pump motor except it has START-STOP push buttons and is LVP.
Engine room supply fan motor.	Same as raw-water pump motor except type is SCA- 3. It has START-STOP push buttons and is LVP.
Dravo heater blower motor.	Same as raw-water pump motor except it has a three-position selector switch and is LVR.
Fire pump motor.	Square D, Type SOA-1, Class 8606; has magnetic reduced-voltage autotransformer starter with local START-STOP push buttons. LOCAL-OFF-REMOTE switch has a 240/ 120-VAC step- down transformer for internal control and a 120-VAC, 60-Hz LVP coil with three thermal overload relays. (Main contactor has one normally closed auxiliary contact for interlock with air compressor.)
Air compressor motor.	Same as above except for HAND-OFF-AUTO switch instead of LOCAL-OFF-REMOTE switch. Acts as LVP when in HAND position and as LVR when in AUTO position. When in AUTO position, compressor operation is controlled by a pressure switch located in air supply line.

MAINTENANCE

The following tables present maintenance procedures and troubleshooting charts for power distribution equipment.

Preventive maintenance

Before beginning maintenance procedures on the power panels. notify operators that power will he de-energized.

WARNING: Ensure that—

- **AC generators are not running.**
- **Shore power is not selected.**
- **Generators are tagged "Out of Service."**
- **Power circuit breakers are open and tagged "Out of Service."**
- **Rubber matting is placed on deck around the working areas.**

Once these precautions have been taken, set mechanical interlock to ensure that the shore-power circuit cannot be closed.

The following procedure is used to clean and inspect the power panels.

WARNING: Remove rings, watches, **chains, and** other metallic articles before working in the power panels.

Step 1. Open or remove access covers. (WARNING: Wear rubber test gloves.)

Step 2. Test all bus bars, circuit breakers, and cable connections with voltage tester to ensure that areas/components are not energized. (WARNING: Use only insulated tools.)

Step 3. Vacuum accessible components and surface areas. Use dusting brush to loosen dirt.

Step 4. Wipe components and surface areas with lint-free rags.

Step 5. Operate switchboard disconnect links to ensure freedom from mechanical binding and proper alignment.

Step 6. Inspect contact surfaces to ensure that they are free of deep pitting and projections.

Step 7. Inspect electrical and mechanical connections for tightness. Tighten loose connections; as necessary, use jam nuts or lock washers to keep connections tight.

Step 8. Inspect bus bar supports; ensure that supports will prevent grounding or short circuiting of bus work during periods of shock.

Step 9. Inspect wiring for evidence of over-heating and chafing and frayed or chipped insulation.

Step 10. Clean components and surface areas with clean, lint-free rags.

Step 11. Clean electronic components and vicinity with camel-hair brush.

Step 12. Inspect electronic components for discoloration, blistering, bulging of con-tainers, and leakage of insulating compounds.

Step 13. Reinstall dust covers where applicable.

Step 14. Inspect resistors, rheostats, and potentiometers, as applicable, for evidence of overheating.

Step 15. Inspect contact surfaces for sharp projections, pitting, misalignment, and evidence of overheating.

> ***NOTE:*** The brown discoloration found on silver and silver-plated contacts is harmless Silver or silver-plated contacts should not be dressed unless sharp projections extend beyond contact surfaces.

Step 16. Ensure that plug-type connectors are clean, tight, and straight.

The following procedure is used to clean and inspect the circuit breakers.

Step 1. Test with voltage tester to ensure that circuits are de-energized.

Step 2. Gain access to and remove arc chutes.

Step 3. Vacuum accessible components. Use dusting brush to loosen dirt.

Step 4. Inspect wiring for evidence of overheating and chafing and frayed or chipped insulation.

Step 5. Inspect electrical and mechanical connections for tightness. Tighten loose connections, as required; use jam nuts or lock washers to keep connections tight.

Step 6. Inspect contact surfaces for sharp projections, pitting, misalignment, and evidence of overheating.

> *NOTE:* The brown discoloration found on silver and silver-plated contacts is harmless. Silver or silver-plated contacts should not be dressed unless sharp projections extend beyond contact surfaces.

Step 7. Inspect chutes for breaks, burns, and evidence of carbonizing.

Step 8. Reinstall arc chutes.

Step 9. Operate circuit breaker manually through three cycles of operation to detect erratic operation or mechanical binding.

Step 10. Reinstall circuit breakers as applicable.

Step 11. Remove work materials from switchboard.

Step 12. Close or reinstall access covers.

Step 13. Remove safety tags, and return equipment to normal readiness condition.

Step 14. Notify operators that power is restored.

Corrective maintenance

The following tables apply to maintenance of power distribution equipment.

Troubleshooting Chart : Contacts on Motor Controller

SYMPTOM	PROBABLE CAUSE	REMEDY
Contact chatter (also see “noisy magnet”)	Poor contact m control circuit.	Replace the contact device, or use holding circuit interlock (3-wire control).
	Low voltage.	Check coil terminal voltage and voltage dips during starting.
Welding and freezing.	Abnormal inrush of current.	Check for grounds, shorts, or excessive motor load current, or use larger contactor.
	Insufficient tip pressure.	Replace contacts and springs; check contact carrier for deformation or damage
	Low voltage preventing magnet from sealing.	Check coil terminal voltage and voltage dips during starting.
	Foreign matter preventing contacts from closing.	Clean contacts with solvent. Contacts, starters, and control accessories used with very small current or low voltage should be cleaned with Freon.

Troubleshooting Chart : Contacts on Motor Controller (Continued)

SYMPTOM	PROBABLE CAUSE	REMEDY
Welding and freezing (Continued).	Short circuit or ground fault.	Remove fault, and check to be sure fuse or breaker rating is correct.
Short tip life or overheating of tips.	Filing or dressing.	Do not file silver tips. Rough spots or discolora-tion tips, will not harm tips or impair their efficiency.
	Interrupting excessively high currents.	Install larger device, or check for grounds, shorts, or excessive motor currents.
	Weak tip pressure.	Replace contacts and springs; check contact carrier for deformation or damage
	Dirt or foreign matter on contact surface.	Clean contacts with solvent. Take steps to reduce entry of foreign matter into enclosure.
	Short circuit or ground fault.	Remove fault and check to be sure fuse or breaker rating is correct.
	Loose connection in power circuit.	Clean and tighten.
	Sustained overload.	Check for excessive motor load current.

Troubleshooting Chart : Coils on Motor Controller

SYMPTOM	PROBABLE CAUSE	REMEDY
Open circui.t	Mechanical damage.	Handle and store coils carefully.
Overheated coil.	Overvoltage or high ambient temperature.	Check coil terminal voltage which should not exceed 110 percent of coil rating.
	Incorrect cod Shorted turns caused by mechani-cal damage or corrosion.	Install correct coil. Replace coil
	Undervoltage, failure of magnet to seal in.	Check coil terminal voltage which should be at least 85 percent of coil rating.
	Dirt or rust on pole faces.	Clean pole faces.
	Mechanical obstruction.	With power on OFF, check for free movement of contact and armature assembly.

Troubleshooting Chart : Overload Relays on Motor Controller

SYMPTOM	PROBABLE CAUSE	REMEDY
Tripping.	Sustained overload.	Check for excessive motor currents or current unbalance between phases; correct cause.
	Loose or corroded connection m power circuit.	Clean and tighten.
	Excessive coil voltage.	Voltage should not exceed 110 percent of coil rating.
Failure to trip.	Mechanical binding, dirt, corrosion, and so forth.	Replace relay and thermal units.
	Relay previously damaged by short circuit.	Replace relay and thermal units.
	Relay contact welded or not in series with contractor coil.	Check circuit for a fault, correct condition. Replace contact or entire relay as required.

Troubleshooting Chart: Magnetic and Mechanical Parts on Motor Controller

SYMPTOM	PROBABLE CAUSE	REMEDY
Noisy magnet.	Broken shading coil.	Replace magnet and armature.
	Dirt or rust on magnet faces.	Clean.
	low voltage.	Check coil terminal voltage and voltage dips during starting.
Failure to pickup and seal.	No control voltage.	Check control circuit for loose connection or poor continuity of contacts.
	Low voltage.	Check cod terminal voltage and voltage dips during starting.
	Mechanical obstruction.	With power on OFF, check for free movement of contact and armature assembly.
	Coil open or overheated.	Replace.
	Wrong coil.	Replace.
Failure to dropout.	Gummy surfaces on pole faces.	Clean pole faces.
	Voltage not removed.	Check coil terminal voltage and control circuit.
	Worn or corroded parts causing binding.	Replace parts.
	Residual magnetism due to lack of air gap in magnet path.	Replace magnet and armature.
	Contacts welded.	Replace contacts.

Troubleshooting Chart : Manual Starters on Motor Controllers

SYMPTOM	PROBABLE CAUSE	REMEDY
Faliure to reset.	Latching mechanism worn or broken.	Replace starter.
Burnouts.	Short circuits or grounds.	Remove grounds or shorted conditions.
	Overheating.	Increase low contact pressure; remove dirt, oil, or grease, remove oxides or sulfides.
	Slow "breaking."	Eliminate bred.
	Low lead dimension.	Increase lead dimension.
	Excessive lead dimension.	Reduce lead dimension.
Excessive wear.	Excessive jogging or inching.	Do not jog or inch controllers unnecessarily.
	Faulty blowout assembly or arc shield.	Replace or repair blowout coil; eliminate shorted turns.
	Excessive overloads.	Eliminate cause; check current readings.
	Slow "breaking."	Remove bind of parts.
	Excessive filing.	Do not dress or file the contacts unnecessary.
Overheating.	Oil or grease.	Remove with a cloth moistened with methyl chloroform.
	Copper oxides.	Remove with a fine file or 00-grade sandpaper.
	Low spring pressure.	Increase pressure or replace spring.
	Loose contacts.	Tighten.
Welding or sticking.	Ground or excesslve overload.	Eliminate cause; check current readings.
	High spring pressure.	Reduce pressure.
	Low voltage.	Increase voltage.
	Slow "making" or bred.	Remove bind.
Excessive arcing or sputtering.	Short circuit or ground.	Remove grounded or shorted circuit.
	Binding parts.	Eliminate bind of parts.
	Faulty blowout assembly.	Replace or repair blowout coil; eliminate shorted turns.
	Excessive lead dimension.	Reduce to increase contact gap.